SD-WISHEES

TOWARDS A ROADMAP

On strategic R&I needs and priorities for the protection of cultural heritage from the impacts of extreme hydroclimatic events

A consultative roadmap highlighting strategic R&I needs and priorities in the domains of hydroclimatic extreme events – cultural heritage, including R&I recommendations, best practices, success stories, and lessons learnt, with a special focus on how to enhance collaboration and the focus on priorities at the national and regional levels.

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Executive summary

This draft consultative roadmap (hereinafter roadmap) outlines strategic R&I needs and recommendations for enhancing and widening collaboration for the protection of cultural heritage from hydroclimatic extremes. The roadmap represents the collaborative efforts of 16 organisations across Europe, the Balkans, and Africa – with financial support from the European Union – working under the auspices of the SD-WISHEES.

SD-WISHEES strives to enhance collaboration with widening countries to the Horizon Europe Programme by enhancing the understanding of the needs and mechanisms for widening collaboration. The project aims to enable strategic coordination and cross-sector collaboration between national (R&I) funding members, researchers, innovators and a wide variety of stakeholders to address together the protection and adaptation of cultural heritage (including natural heritage and intangible assets such as knowledge and traditions) in Europe and beyond from hydroclimatic extremes.

This draft roadmap is premised on extensive literature reviews, stakeholder consultations, and analyses of innovation pathways to address pressing gaps in research, policy, technology, and practice. As summarized below, the roadmap emphasises the need for localised and context-specific interventions in addition to strategic alignment with international frameworks.

Key R&I Gaps

- **Governance and policy frameworks**: Insufficient integration of cultural heritage into broader climate adaptation and disaster risk reduction policies based on lack of inadequate political will, capacity and knowledge.
- **Technical and methodological approaches**: limited understanding of how various cultural heritage assets are vulnerable to specific hydro-climatic risks. Underutilisation of advanced technologies like remote sensing, Internet of Things (IoT), and Artificial intelligence (AI) for real-time monitoring and predictive analytics resulting in a lack of relevant data for decision-making.
- **Climate-resilient conservation materials and methods -** lack of materials and techniques specifically designed for heritage conservation and protection that are both climate-resilient and compatible with the original materials of historic buildings and artifacts.
- **Funding and resource allocation:** Insufficient funding dedicated to researching the protection and adaptation of cultural heritage from climate change impacts, driven by limited understanding of effective resource allocation strategies and the absence of international frameworks ensuring sustainable funding.
- **Regional and international collaboration**: Scarcity of adequate R&I cooperation and demonstration projects that crosscut several regions with common challenges and opportunities, reducing the possibilities for replication and scale.

- **Knowledge and capacity enhancement**: Limited research on how to engage local communities in preserving their heritage against climate risks. Scarcity of specific educational programmes on tangible and intangible cultural heritage and on the environment (natural heritage), both at primary and secondary school level and at university level.

Key focus areas for enhancing and widening collaboration on R&I

- ***Knowledge and capacity enhancement***: Raise awareness at governmental and citizen levels on the impact of extreme hydro-climatic events for all kinds of cultural heritage, and the need for proactive adaptation strategies, planning and action.
- ***Governance and policy frameworks***: Strengthen governance structures to facilitate disaster risk identification and management and foster a national catalogue of tangible, intangible and natural cultural heritage assets by defining scales of value and priorities for action.
- ***Technical and methodological approaches***: Identify and resource the engagement of qualified and experienced experts to promote the utilization of globally recognized practices for field-study, documentation, inventorying, and protection of cultural practice. Active co-creation with the communities of any kind of cultural heritage helps to increase adoption of sustainable solutions. Especially, for intangible heritage, this should entail consultation with custodians of traditions and cultural practices,
- ***Adaptation strategies and planning***: Improve inclusivity and engagement of stakeholders by considering the role of power dynamics, donors, and leadership in heritage protection and adaptation decisions. In addition, take a long-term view of the results, prioritising sustainability through models for enduring solutions that engage local communities, and allowing flexibility in budgeting for this to occur.
- ***Regional and international collaboration***: Strengthen and widen platforms, such as Europe's Cultural Heritage in Action to encourage enhanced R&I collaboration across countries and regions, share learnings and build on each other's expertise.

This draft roadmap is a working and living document that will be improved with stakeholder consultations during the SD-WISHEES project and beyond.

1. Background

In 2023, sixteen (16) organisations representing research funding organisations (RFOs), research performing organisations (RPOs), foundations, non-governmental organisations and private companies embarked on an ambitious project aimed at developing innovative tools and strategies to enable and strengthen trans-national collaboration between national research and innovation funding members to address together the protection and adaptation of cultural heritage in Europe and beyond. The Consortium, whose membership is drawn from Albania, Belgium, France, Georgia, Italy, Malta, UK, Kenya, Portugal, Spain, Romania, and The Netherlands, was convened by the European Union (EU)'s Climate Joint Programming Initiative[1] (JPI Climate) and Water JPI[2], under the auspices of the SD-WISHEES[3] project. The SD-WISHEES project is funded by the EU and implemented from 2023-2026, under the coordination of the National Research Council of Italy (*Consiglio Nazionale delle Ricerche)*.

SD-WISHEES strives to enhance collaboration with widening countries to the Horizon Europe Programme by enhancing the understanding of needs and mechanisms for widening collaboration. The project aims to enable strategic coordination and cross-sector collaboration between national (R&I) funding members, researchers, innovators and a wide variety of stakeholders to address together the protection and adaptation of cultural heritage in Europe and beyond in response to increasingly more frequent and severe hydroclimatic extreme events such as droughts and floods. Cultural heritage here refers to historical sites, natural sites, and intangible assets (i.e. knowledge, traditions, ecosystem services).

This draft roadmap has been produced following a literature review and analytical research on the existing policy and sustainable practice gaps and priority issues in the domains of the impacts of water-related and climate-related hazards on cultural heritage (also referred to as the "*water(hydro)-climate-cultural heritage nexus*", or the **WCCH Nexus**, within SD-WISHEES). In addition, these impacts are expected to be exacerbated by climate change as well as by anthropic pressures. The roadmap also draws from an initial expert and stakeholder engagement process as well as an analysis of existing innovation pathways that can be used to enhance and widen the uptake of R&I results in the context of cultural heritage threatened by hydroclimatic extreme events.

[1] https://jpi-climate.eu/

[2] http://www.waterjpi.eu/

[3] **S**upporting and **D**eveloping **Wi**dening **S**trategies to tackle **H**ydroclimatic **E**xtreme **E**vents: impacts and **S**ustainable solutions for cultural heritage

2. Rationale for the roadmap

Placing culture at the heart of development policies is the only way to ensure a human-centred, inclusive and equitable development. The safeguarding and promotion of culture is an end in itself, and at the same time it is a cornerstone of the three pillars of sustainable development – social, economic and environmental objectives. In addition, Global Agreements – such as the Paris Agreement and the 17 United Nations Sustainable Development Goals (UN SDGs) – acknowledge its potential to play an active part in the transition towards more sustainable socio-economic and governance models[4]. Scientific findings in the domain[1] indicate that climate change can exacerbate transformations of cultural heritage through gradual variations in temperature or the occurrence of hydroclimatic extreme events such as flooding, droughts and heatwaves (Bertolin, 2019[5]). In particular, water hazards constitute a major risk for the maintenance of worldwide cultural heritage, having been ranked as first driver in the loss of our legacy in Europe (Sesana et al., 2021[6]). Water hazards to cultural heritage can manifest in different ways including flooding, debris flow, construction of dams, destruction of wetlands, acid rain, saline waters near monuments, weathering, sea-level rise/ coastal changes and even socio-economic factors related to water disasters[7]. As of March 2021, a UNESCO assessment revealed that 35% of natural sites and 21% of intangible and tangible cultural assets are exposed to high flood risk. Long episodes of severe and extreme droughts and desertification are also responsible for the degradation of sites and population migration, leading ultimately to the loss of indigenous knowledge and traditions.

Societies have traditionally sought to protect and preserve their cultural heritage due to educational, historical or identity reasons. Other than the good practices and innovation activities driven at the national level (e.g. Japan, Italy, Turkey and UK), the international Hyogo Framework for Action and the Sendai Framework for Disaster Risk Reduction 2015-2030 as well as the SDGs provide the foundation for enabling the preservation of cultural assets. In the face of climate change and related current and likely future increases of hydroclimatic extremes and related water hazards, it is more important than ever to safeguard and protect cultural assets worldwide and to explore innovative and sustainable measures for their protection, restoration and management.

The scientific community has a key role to play in the protection of cultural heritage through the provision of cutting-edge knowledge on the impacts of climatic and water

[4] https://www.heritageresearch-hub.eu/app/uploads/2022/03/White-Paper-March-2022-def-14-mars.pdf
[5] Bertoli C., 2019. Preservation of Cultural Heritage and Resources Threatened by Climate Change Geosciences, 9(6), 250; https://doi.org/10.3390/geosciences9060250
[6] Sesana E., A.S. Gagnon, C. Ciantelli, J. Cassar, J.J. Hughes, 2021. Climate change impacts on cultural heritage: A literature review. WIREs Clim Change,12:e710, http://doi.org/10.1002/wcc
[7] https://www.researchgate.net/publication/332710999_WATER_HAZARDS_AND_CULTURAL_HERITAGE_AN_OVERVIEW

hazards on cultural assets, the identification and implementation of best available adaptation measures/solutions, and the communication/ dissemination of scientific results both to policy makers and the public in general. Research in this area is complicated by the need for a wide range of disparate scientific disciplines to solve complex problems in often remote and highly contextual locations. It therefore calls for a concerted effort to direct research and innovation into this area. Hence, this consultative roadmap highlights a range of strategies for promoting and supporting R&I collaboration for the protection and adaptation of cultural heritage from the impacts of extreme hydroclimatic events, in various contexts. Specifically, this roadmap provides stakeholders with:

1) Concrete **recommendations for enhancing and widening R&I collaboration** for the protection of cultural heritage from extreme hydroclimatic events, based on, *inter alia*, a detailed co-creation process with the stakeholders, and
2) Examples of plausible **R&I pathways** to facilitate collaboration and actions for the protection of cultural heritage from extreme hydroclimatic events through tailored climate adaptation and mitigation solutions.

This roadmap aims to support the European Union, and the widening countries, specifically including the Balkans and Africa (through the African Union), and local users within the cultural heritage sector (including businesses, RFOs, and policy makers) to implement actions aimed at enhancing the protection of cultural heritage from the impacts of hydroclimatic extreme events. The roadmap will also be useful for national and regional policymakers, decision-makers, civil society organizations, academia and other actors in the cultural heritage domain.

3. Context and framing

Cultural heritage is defined by UNESCO as "the legacy we receive from the past, what we live with today, and what we pass on to future generations". It is who we are and what shapes our identity. Cultural heritage does not end at monuments and collections of objects (tangible culture). It also embeds intangible culture (i.e., wealth of knowledge and skills transmitted from one generation to the next such as social practices, traditions, language and knowledge) and natural sites (landscapes, biodiversity).

Scoping research gaps and opportunities at the interface of cultural heritage and climate change[8], conducted under the auspices of two Joint Programming Initiatives (JPI Cultural Heritage and JPI Climate) and published in 2022, highlighted the following key messages:

- Research on individual geopolitical regions, or a few in immediate vicinity of one another, remains prevalent: there is an opportunity to stimulate research and knowledge exchange that crosscuts several regions which, although geographically disparate, present common challenges and opportunities.
- Quantitative and qualitative methods remain siloed in their applications; mixed methods, which reflect a cross-disciplinary approach, are more likely to be found in pre-policy publications.
- There is a need for further understanding of culture and heritage as embedded in their socio-environmental contexts to inform policy, including the role of traditional and local knowledge, as well as learning from the past.
- The ecological and social impacts related to losses and opportunities for cultural assets and values from adaptation and mitigation need to be researched more intensively.

Additionally, the report identified the need for more advanced knowledge to inform climate change adaptation and mitigation strategies for the protection of cultural heritage from hydroclimatic extremes:

- Predicting and assessing the impacts of climate change on and through cultural heritage.
- Strengthening the commitment of the cultural heritage sector to address climate emergency.
- Assessing the potential of cultural heritage to inform the development of climate adaptation.
- Building protection and adaptation strategies for cultural heritage.
- Investigating how cultural heritage can support societal transformations and be a resource for climate mitigation and sustainable futures.

[8] https://www.heritageresearch-hub.eu/app/uploads/2022/03/White-Paper-March-2022-def-14-mars.pdf

This consultative roadmap presents recommendations for strategic means of enhancing R&I collaboration to generate knowledge on the impacts of hydroclimatic extremes on cultural heritage. The roadmap also highlights good practices, needs, and priorities for widening the R&I collaboration for the protection of cultural heritage.

4. Needs and priority areas for enhancing collaboration on R&I for protection of cultural heritage from hydroclimatic extremes

4.1 R&I needs and priorities for the protection of cultural heritage

The identification of research and innovation (R&I) needs and priorities for the protection and adaptation of cultural heritage from hydroclimatic extreme events has been guided by a comprehensive literature review conducted under the SD-WISHEES project. This review was further complemented by stakeholder consultations, resulting in a list of key gaps in R&I, globally, as follows:

4.1.1 Governance and Policy Frameworks

- **Policy Integration and Cross-Sector Collaboration -** Policies to protect and adapt cultural heritage are often not integrated with broader climate adaptation strategies or disaster risk reduction (DRR) plans. A key gap exists in ensuring interdisciplinary collaboration between heritage conservationists, climate scientists, hydrometeorology experts, water managers, urban planners, and policymakers to create more holistic and compatible approaches.

4.1.2 Knowledge and Capacity Enhancement

- **Planning and Implementation Challenges, Vulnerability Assessment and Risk Mapping –** There is limited understanding of how various cultural heritage assets are vulnerable to specific hydro-climatic risks. Localized risk maps for cultural heritage sites are lacking, along with established processes and preservation guidelines for planning and implementing climate adaptation actions. Risk maps are the main tool for planning protection and intervention, providing the possibility to rank priorities of both preventive and post-disaster actions. The assessment of risk maps involves defining the value of the asset, determined by both its universal value and the symbolic importance it constitutes for the local community.

4.1.3 Technical and methodological approaches

- **Technological Innovation for Monitoring and Preservation** - Lack of advanced technological tools and techniques to monitor, document, and protect cultural heritage from hydro-climatic threats. Innovations such as remote sensing, drones, and IoT sensors for real-time monitoring, as well as new materials and techniques for climate-resilient conservation, require more development and testing. Sensors and real-time data collection tailored for heritage sites, combined with AI for predictive analysis are not well developed. Technologies like 3D scanning, digital twin models,

and virtual reality are still underutilized. Some geographical areas have little or no efficient hydro-meteorological and agro-meteorological monitoring networks for early warning systems.

There is also a need for monitoring and assessing the vulnerability of intangible and natural cultural heritage.

- **Climate-Resilient Conservation Materials and Methods -** Conventional materials and conservation methods are often insufficient to deal with climate change-induced hydroclimatic risks like water infiltration and increased humidity. There is a lack of materials and techniques specifically designed for heritage conservation that are both climate-resilient and compatible with the original materials of historic buildings and artifacts. Specific studies on certain building materials particularly vulnerable to extreme natural and hydro-climatic phenomena such as the raw brick, which is very common in African countries are lacking. For the stone monuments of the Balkans (e.g., medieval tombstones Stecci, UNESCO World Heritage), exposed to strong temperature changes, humidity, rain and snow, erosion and biological colonization are the greatest threats. The situation is likely to worsen in view of climate change. African stakeholders also highlighted the importance of adopting localized approaches to protect and restore cultural heritage sites affected by extreme hydroclimatic events. They emphasized that solutions must be context-specific, respecting the unique cultural, historical, and environmental characteristics of each site. For instance, if a site like Fort Jesus in Mombasa is at risk of degradation, it should be repaired and preserved using local materials and techniques that align with its historical construction methods and the cultural identity of the region. Preservation approaches used in other regions, such as forts in Vienna or other European settings, may not be directly applicable due to differences in climate, materials, and cultural context.
- **Monitoring of sites, monuments, and intangible assets**. There is need for monitoring and assessment of the vulnerability of tangible, intangible, and natural heritage, considering local environmental, climatic, and socio-economic conditions to facilitate development of protection measures.

4.1.4 Adaptation Strategies and Planning

- **Social and Economic Impacts -** The broader social and economic consequences of climate change-induced hydroclimatic events on communities that depend on cultural heritage for their identity, tourism, and (local) economy are under-researched. There is a gap in understanding how the loss or damage to heritage could affect local economies and social cohesion.
- **Post-Disaster Recovery and Heritage Restoration -** Limited strategies exist for post-disaster recovery that address both the physical restoration and the socio-cultural recovery of heritage sites. Research is needed on how to restore cultural

heritage in a way that is resilient to future climate risks, while also maintaining the cultural value of the site.

4.1.5 Regional and International Collaboration

- **Heritage-tourism relationship**. The sustainable management and exploitation of cultural heritage can be a resource of great economic value for local communities through increased tourism. While opening of sites, territories and events to national and international public can foster investments aimed at their maintenance, adaptation, monitoring and exploitation, the presence of high tourist flows necessarily force to adopt plans to face extreme phenomena that could put at risk the safety of visitors (for example, as happened several times in Petra, Jordan). In addition, the unregulated increase of tourist traffic can lead to considerable problems of conservation and security, as well as the loss of integrity of the property and therefore of the universal value that has made it famous internationally. A balanced relation between the protection and adaptation of tangible and intangible heritage, the promotion of international tourism flows, including in relation to environmental and climate risks, must be addressed by policymakers to foster a slow, conscious and sustainable tourism.
- **Adaptation and Mitigation Strategies, Cross-Sector Collaboration, and Policy Integration -** existing adaptation strategies often focus on natural and urban environments, but there is a gap in specific methods tailored for preserving cultural heritage. There is a gap in integrating cultural heritage protection into broader climate adaptation and disaster management policies. There is a lack of political will, support and long-term commitment into integrating cultural heritage preservation in national climate action plans. Innovation in policy frameworks that align heritage conservation with climate resilience strategies is required.

  In addition, African stakeholders highlight that, while global strategies offer useful frameworks, they often fail to account for the specific needs and conditions of African countries. It is essential to develop regional strategies within Africa to ensure their relevance and effectiveness. These strategies should also include a clear prioritization of heritage sites that face the greatest risks.
- **Public Awareness and Community Engagement -** Limited research has been done on how to engage local communities in preserving their heritage against climate risks. There is a gap in educational programs and community-driven initiatives that can raise awareness about the importance of protecting and adapting cultural heritage against the threats of hydroclimatic extreme events.
- **Funding and Resources for Cultural Heritage Protection and Adaptation.** There is insufficient funding dedicated to researching the protection and adaptation of cultural heritage from climate change impacts. A key gap exists in understanding how to effectively allocate resources, and there is a need for international frameworks to ensure sustainable funding for these initiatives. Moreover, there is need to be

culturally sensitive when engaging in R&I exchanges between regions (e.g., north-south)

- **Limited research on the impacts affecting Intangible Cultural Heritage -** The focus of existing research is often on built heritage, leaving a gap in addressing how climate change induced hydroclimatic extreme events affect intangible cultural heritage like festivals, agricultural practices, and local knowledge systems. In addition, local communities and policy stakeholders do not properly conceptualise the cultural relevancy of some heritage, including language and storytelling aspects of culture**.**

4.1.6 R&I needs and priorities clustered by region

4.1.6.1 Africa

- Research and stakeholder consultations have shown that African countries face specific challenges in protecting cultural heritage from climate-related threats. A key issue raised is that European approaches often fail to consider Africa's specific cultural, environmental and socio-economic contexts. It is emphasised that African countries need to define their own cultural heritage and develop mitigation and adaptation strategies based on their histories, identities and priorities, rather than relying on externally imposed frameworks.
- This autonomy is seen as essential to ensure that mitigation and adaptation efforts are relevant to local realities and address the continent's specific challenges. However, the lack of data, research and knowledge sharing focused on Africa leaves its unique contexts underrepresented in global studies. The lack of data makes it hard to create effective risk maps, adaptation strategies, and models specific to Africa, which are needed to show the long-term impacts of climate change and encourage investment in local conservation efforts.
- Given that global frameworks often fail to address Africa's specific challenges, there is a strong emphasis on the need to develop regional strategies led by African stakeholders. These strategies should prioritise the most endangered heritage sites and include solutions that reflect the cultural diversity and complexity of the continent. Local communities must play an integral role in the development of these strategies to ensure relevance, promote local ownership and ensure long-term sustainability.
- Raising awareness of the urgency of protecting cultural heritage from climate risks is also a major challenge for Africa. The potential of African artists and creative professionals, especially the younger generation, is highlighted as a powerful means of creating innovative and accessible communication strategies that resonate with diverse audiences. Art is seen as a powerful tool for bridging gaps between communities, researchers and policy makers, while raising awareness in an engaging way.
- The need to establish African-led networks for knowledge exchange is recognised as essential. These networks will help connect experts, institutions and

practitioners across the continent, facilitating the sharing of best practices and the co-development of solutions. Education and training programmes tailored to local needs are also seen as essential to strengthen the capacity of communities to contribute meaningfully to the protection and adaptation of cultural heritage.

- Creating employment opportunities in areas such as research, restoration and community education is seen as essential both to support conservation efforts and to strengthen local economies. Breaking down language and cultural barriers among young professionals is also seen as a key step in fostering cross-regional collaboration and innovation.
- There is an urgent need to develop dedicated financial mechanisms to support climate adaptation and heritage preservation efforts.

4.1.6.2 Europe

Specific information on Europe R&I needs and priorities will be added to the next version of the Roadmap, after European stakeholders meetings planned on 2025 and 2026.

4.1.6.3 Balkans

- In the Balkan peninsula, the issue of climate change is clearly not a priority issue, both from a governance perspective and from a technical and practical perspective.
- Many Balkan countries such as Albania, North Macedonia, Montenegro and Serbia mostly link their approach to climate change closely to their obligations within the framework of the integration process with the European Union. In this way, the adaptation of the regulatory and institutional framework on climate changes is still in the pioneering stages. However, apart from the similarity in all Balkan countries in this respect, each of the countries shows its own specificities. Specificities in many cases need better harmonization considering that the region is relatively small compared to the European continent itself. In this context, Albania, for example, has a scattered approach to addressing and governing the effects of climate change. So, there is no single institutional line that is solely responsible for addressing climate change in terms of policy making and implementation. The model that Albania has built is an inter-institutional model, where several public bodies are jointly performing to address the climate changes. Thus, Ministries such as the Ministry of Infrastructure and Energy, the Ministry of Tourism and Environment, and the Ministry of Agriculture and Rural Development are the three main institutions that manage the climate change sector. These institutions are responsible for drafting policies, strategies, regulations, drafting monitoring reports, and National Plans.
- At the local level, each municipality is responsible for drafting and implementing a climate change adaptation action plan. These plans are drafted based on the directives of the National Plan, which is drafted by the inter-institutional group.

- The basic document that is taken as a reference point for climate change is the National Climate Change and Adaptation Strategy. This is a document that is drafted in cooperation by several ministries and has an implementation timeline of 10 years. The document is approved by the Council of Ministers and defines the main areas of action for addressing climate change. In the case of Albania, the Strategy was approved in 2019. The Strategy is the document based on which the national action plan for climate change is developed. This strategy focuses on the following four reporting sectors of the greenhouse gas inventory in Albania: i) Energy; ii) Transport, iii) Agriculture and the iv) Land Use Change and Forestry (LUCF) sectors, thus covering 80% of Albania's emissions. The NCCAS (the adaptation aspect of the National Action Plan) provides a guiding direction and concrete actions for the adaptation process in Albania, together with the Climate Change Adaptation (CCA) framework. The national vision focuses strongly on the three main components of climate change in Albania: mitigation, adaptation and sustainable development. Six strategic priorities of the mitigation strategy (SP) have been identified:
    - SP.1: Ensuring sustainable economic development in accordance with the paths set out in the Strategy, and moving towards an economy-wide objective, to which all sectors contribute;
    - SP.2: Establishing a GHG monitoring, reporting and verification system in line with EU requirements;
    - SP.3: Strengthening the capacity of relevant institutions and inter-institutional cooperation to address climate change issues;
    - SP.4: Improving climate change in sectoral strategic planning;
    - SP.5: Strengthening capacity and awareness on climate change issues;
    - SP.6: Approximation with the EU legal framework on climate change in all sectors
- The Climate Change Mitigation Plan identifies 222 measures, mainly focused on a short-term period (until 2020), as well as some others set for the medium (2030) and long-term (2050) periods. The main part of the measures stem from existing strategies and plans, some of them are new proposals to address gaps or synergies. Most of the measures are in the energy sector (77) and the transport sector (71), followed by LUCF (53), Agriculture (17) and 4 cross-sectoral measures. Special attention is paid to the measurement, monitoring and reporting system in Albania. Meanwhile, if referring to the document monitoring the progress of the National Adaptation Plan for the period 2019-2023 in Albania, the data shows that very little progress has been made in the implementation of the adaptation measures plan. The assessment results that:
    - only 15% of adaptation measures are reported as completed during the assessment period.
    - 22% of all planned measures had not yet started. This lack of implementation was reported mainly in Priority Action (PA) 4 (implementation monitoring

system), PA 7 (climate-resilient irrigation, drainage and flood protection) and PA 9 (adaptation in the agricultural sector).
    - On the positive side, measures have been taken to start implementation for around 69% of all measures included in Albania's Climate Adaptation Plan (CAA) during the 4-year implementation period. This percentage represents the cumulative total of measures that have been initiated, are ongoing, partially completed or fully completed.
    - It is worth noting that active implementation of measures has mainly occurred from the end of 2021 onwards. This delay was mainly due to the 2019 earthquake in Albania, which led to a reallocation of funding towards reconstruction efforts, and the significant disruptions caused by the COVID-19 pandemic in 2020 and 2021. These events greatly impacted the capacity of agencies to implement planned annual work programmes and projects.
    - Only one Priority Action, VP 15 (building resilience of the Kune Vain lagoon through Nature Based Adaptation), was reported as fully completed.
- As regards the effect of the climate changes on the natural and cultural heritage, very limited attention is paid on the governance and technical aspects in Albania. In this regard, both the strategy and the Action Plan do not foresee the adoption of monitoring or adaptation measures to climate change and specifically its effects on the sites designated and registered in the national register of cultural monuments. The only plans for these objects are the monitoring and restoration plans drafted by the Ministry of Culture and Economy and implemented by the National Institute of Cultural Heritage. Referring to the above, in Albania there is an urgent need for the climate change approach to include aspects of natural and cultural heritage and not be limited only to sectors of the productive economy.
- Strategic documents and plans need to include aspects of measures to be taken to mitigate the effects of climate change on natural and cultural heritage sites. This approach should also include the institutional framework, including specialists and representatives of the cultural heritage sector in inter-institutional groups addressing climate change. Also, the Ministry of Culture and Economy alone should develop internal human resources in addressing the effects of climate change on cultural heritage sites.
- Finally, in line with the increase in human and regulatory capacities, there must also be an increase in financial capacities in addressing climate change.

Other areas of consideration include:

- **Lack of long-term planning**. A substantial lack of continuity in the planning and protection of the landscape and cultural heritage is highlighted. Frequent changes at management levels hinder the planning of wide-ranging interventions for coordinated and multidisciplinary prevention plans. There is a general lack of

policies or guidelines addressing hydroclimatic extreme events and cultural heritage together

- **Collaboration among Balkan Countries and Institutions.** Although collaboration between Balkan countries has been effectively initiated — for example, in projects related to heritage digitization, preventive conservation, specific monument restoration, and the nomination of Stećci monuments to the UNESCO World Heritage List — there is a growing need for more extensive cooperation. This includes research projects focused on protecting heritage from natural phenomena in areas with similar environmental and architectural characteristics.
- **Education and Training**
    - **Activation of degree courses**. In some Balkan countries, such as Montenegro, there are no specific academic courses on the conservation and management of cultural heritage. Launching such programs is essential for disseminating knowledge about historical and environmental context analysis, as well as adopting modern procedures for documentation, monitoring, risk assessment and data dissemination.
    - **School programs.** School curricula must include activities aimed at raising students' awareness of natural and cultural heritage. Only through an educational action that starts from early childhood can future citizens develop care and respect for their territories and cultural assets.
    - T**raining of Professionals.** There is a lack of specific training for professionals working in heritage conservation. This is particularly evident in their preparedness to handle extreme hydroclimatic events. Local operators are often unaware of European and international initiatives being implemented. Participation in international organizations and working groups is needed.
- **Cultural Landscape and Territorial Planning.** Although the interior Balkans remain largely unspoiled, with extensive forested areas and a dense river network, harmful human interventions—such as intensive deforestation, artificial erosion, waste disposal, and pollution—are common. Strong economic interests threaten coastal areas through over-urbanization. The importance of landscape protection is not sufficiently understood either at the level of territorial planning policies or among local communities.
- **Diffuse Heritage.** The cultural heritage of the Balkans is diffuse, often is located in isolated places and therefore risks being forgotten. Specific interventions must be planned, involving local communities, to protect diffuse heritage, especially in inland, mountainous, or complex orographic areas, where institutional intervention is more challenging.
- **Management of Sites and Monuments.** The impact of natural events on archaeological sites and monuments is often worsened by inadequate maintenance. Even significant archaeological sites are frequently neglected, leading to vegetation

overgrowth, blocked drainage channels, and uncontrolled access. An effective and continuous system for safeguarding and monitoring is urgently needed.

- **Conservation Materials and Methods**. For the stone monuments of the Balkans (e.g., medieval tombstones Stećci, UNESCO World Heritage Sites in Bosnia and Herzegovina, Croatia, and Serbia), threats such as temperature fluctuations, humidity, acid rain, snow, erosion, and biological colonization are significant. Climate change is likely to exacerbate these issues. It is essential to develop specific projects for conserving stone materials, including preventive strategies against biodeterioration, also through international collaboration.
- **Museums and Indoor Collections**. Many museums lack intervention plans for extreme climatic events. They also do not have suitable, protected storage facilities in case of disasters, nor do they maintain updated catalogs of their collections.

4.2 Means for enhancing cooperation on R&I

Table 1 highlights key lessons learnt and recommendations for priority areas for enhancing and widening cooperation on R&I for the protection of cultural heritage from hydroclimatic extremes.

Table 1: Recommendations for enhancing R&I collaborations for the protection of cultural heritage from hydroclimatic extremes.

Theme	Lessons learnt	Recommendations
Governance and policy frameworks	• There is need to align R&I efforts with relevant regional and/or continental frameworks (such as the African Union's Agenda 2063) to facilitate government ownership and support. • Culture and heritage should be integrated in disaster risk management and climate change adaptation mechanisms to facilitate adequate resourcing and attention.	• Strengthen governance structures to facilitate disaster risk identification and management and foster rational cataloguing of tangible and intangible assets by defining scales of value and priorities for action. • Where generic national climate change adaptation/mitigation policies exist, develop operational standards and guidelines focusing on cultural heritage. Otherwise, develop a separate but integrated national strategy for the impact of climate change on cultural heritage. An example is Kenya's 2023 National Policy on Culture and Heritage[9] which ensures that local communities receive fair compensation or royalties for the commercial use of their cultural heritage.
Knowledge and capacity enhancement	• There is need for holistic and integrated approaches and enhancement of communication efforts to increase urgency among communities and policymakers. • Incorporation of gender-sensitive indigenous and local knowledge in R&I	• Enhance cooperation between hydrometeorology and climate sciences and cultural heritage managers. • Provide and make available databases and registers of good practice examples at the regional and national levels. • Implement capacity-enhancement activities to enhance human capital in climate adaptation technologies.

[9] https://www.tourism.go.ke/wp-content/uploads/2023/05/NATIONAL-POLICY-ON-CULTURE-AND-HERITAGE.pdf

	cooperation efforts is critical for inclusivity and effectiveness of interventions. • There is a need for more investment in human and technological capacity to accelerate cultural heritage conservation.	• Raise awareness at governmental and citizen levels on climate change impacts and the role of adaptation in protecting and adapting cultural heritage. • Demonstrate the role of cultural heritage in communicating climate change to inspire action through what? E.g. Using socio-economic studies of the benefits of preserving cultural heritage so that is not only seen as a 'nice to have'
Technical and methodological approaches	The future of cultural heritage preservation lies in the ability to balance the old and the new, honouring tradition while embracing innovation.	• Identify and resource the engagement of qualified and experienced experts to promote the utilization of globally recognized practices for field-study, documentation, inventorying, and protection of cultural practice. For intangible heritage, this typically entails consultation with custodians of traditions and cultural practices. • Develop framework programs for monitoring and evaluating the impacts of hydro-climatic extreme events on intangible cultural heritage. Improve data consistency and accessibility within heritage databases for effective analysis. • Address technical, institutional, financial, and socio-cultural barriers through integrated documentation and assessment. • Incentivize local community participation in the knowledge of the problem and possible mitigation and adaptation solutions, e.g., by engaging heritage communities, citizen science initiatives, working with youth, local women and community leaders that understand their climate-induced challenges, and the creative industry to enhance effective engagement with the community.
Adaptation strategies and planning	• The development of sustainable tourism, so-called "slow tourism", as well as safeguarding sites and territories, can bring	• Demonstrate the potential of cultural heritage to support societal transformations and more broadly climate adaptation and mitigation. One way of doing this is by developing and disseminating case studies related to protection and

	economic resources even to remote areas that are not easily accessible. • Intervention strategies must be inclusive, considering the needs and priorities of critical stakeholders such as donors and the local administration. • Research should be extended to the communities that are already strongly impacted by climate change to learn from first-hand experience of the impacts if left to themselves to resolve. In many cases the ancestral solutions are no longer applicable, as villages get washed away, and droughts limit options for food and jobs. • Local women need to be consulted when it comes to local cultural heritage as in many cultures, it is the responsibility of the mother and grandmothers to maintain traditional ways and practices, and these women are the ones also most affected by the potential loss of heritage. • Young people need to be included in the process! Not only do the youth bring fresh ideas and enthusiasm to the consultation processes, but they have the ability to share knowledge quickly and in a creative manner, extending the message of the WCCH-Nexus much more organically. In addition, the	adaptation strategies targeting cultural heritage that also promote learning and scaling up. • Foster community participation in cultural heritage conservation and adaptation practices by, for instance, localising needs, perspectives, and interventions. For example, Mdumbi[10] – a backpacker's group in South Africa – runs various sustainability interventions with the local amaXhosa community engaged as shareholders and employees. Their work aims to promote "community involvement and sustainable eco-tourism". • Improve inclusivity and engagement of stakeholders by considering the role of power dynamics, donors, and leadership in heritage protection and adaptation decisions. • Inclusivity should be extended to the communities that are affected in vulnerable regions to drought and flooding, with the aim of learning about practical solutions that can be applied in even the lowest income regions. • Women need to be consulted in a sensitive manner depending on the local culture and their standing in society. It is not enough to invite women to meetings where they are often too shy to get involved, therefore focus groups, small women-only meetings and cultural acceptable consultation methods need to be applied. • Bring young people into every aspect of the process, and especially the communication and consultation processes. Ensure that young researchers are included in the programme.

[10] https://mdumbi.co.za/

	young are the inheritors of the future, and have a strong vested interest in helping to solve some of the climate and cultural crises. Young researchers especially.	
Regional and international collaboration	• Fostering equitable partnerships is critical for effective cultural heritage conservation. • There is an opportunity to stimulate research and knowledge exchange that crosscuts several regions which - although geographically disparate - present common challenges and opportunities.	• Strengthen and widen platforms, such as Europe's Cultural Heritage in Action[11], for enhanced R&I collaboration across countries and regions. • Leverage existing, and/or develop and utilize, joint programming initiatives such as JPI Cultural Heritage, Water JPI, JPI Climate and PRIMA, as well as collaborative university programs, national programmes, etc.

[11] https://culturalheritageinaction.eu/

4.3 Good practices

- The Interreg Central Europe projects **ProteCHt2save** (https://programme2014-20.interreg-central.eu/Content.Node/ProteCHt2save.html) and **STRENCH** (https://programme2014-20.interreg-central.eu/Content.Node/STRENCH.html) have developed an online tool (WGT) for the interactive visualization of risk maps in Central Europe, with a particular focus on hydro-climatic events. This tool was designed to support regional and local authorities in preparing measures and evacuation plans in case of emergencies.
- In Italy, the main tool is the **Risk Map** developed by the Istituto Superiore per il Restauro. The GIS system allows the mapping of cultural heritage assets and associates each with a risk assessment, thereby facilitating the planning of prevention and conservation interventions (http://vincoliinrete.beniculturali.it/).
- Many Italian regions (e.g., Basilicata, Campania, Tuscany, Emilia-Romagna, Sardinia) have developed systems for cataloging intangible heritage, following national guidelines provided by **the Istituto Centrale per il Patrimonio Immateriale** (ICPI) of the Ministry of Culture. Flood adaptation and sustainable tourism policies in Venice, Italy
- Risk management using advanced hydrological studies in **Petra, Jordan**[12]
- Use of advanced tools such as 3D laser scanning for photogrammetry for digital documentation, the use of drones and satellite imagery for real-time monitoring of risks, and artificial intelligence for predictive modelling of heritage site vulnerabilities.
- In France, the **Cultural Heritage Safeguarding Plan**[13] was formulated for the protection of indoor assets in case of natural disasters (Ministère de la Culture, Territorial Administrative Bodies, Centre de Recherche et de Restauration des Musées de France).
- **PROCULTHER**, Key Elements of European Methodology to Address the Protection of Cultural Heritage During Emergencies, 2022 (https://www.procultther.eu/).
- **REACH** - Improving REsearch capacities of Albanian higher educations in conservation and restoration of Cultural Heritage. It is aimed at supporting the development of multi-disciplinary research skills and technical know-how in the field of Cultural Heritage conservation and restoration in Albania. https://www.reachculturalheritage.eu/. Attention to rural landscapes and the protection of cultural heritage has been developed in Spain through the involvement

[12] Al Kuisi M., N. Al Azzam, T. Hyarat, I. Farhan (2024). Flood Hazard and Risk Assessment of Flash Floods for Petra Catchment Area Using Hydrological and Analytical Hierarchy (AHP) Modeling. Water 16(16), 2283; https://doi.org/10.3390/w16162283

[13] https://c2rmf.fr/sites/c2rmf/files/documents/CULTURAL_HERITAGE_SAFEGUARDING_PLAN_2024.pdf

of local communities (Reach Culture – Pilot project for the protection of cultural heritage in rural areas).

- Definition of training standards to prepare for a rapid and successful involvement of technical experts willing to support the institution (**Proculther**, Key elements of European methodology to address the protection of cultural heritage during emergencies, 2022, 154-164).
- **ICCROM FAR's** "Net Zero: Heritage for Climate Action" (https://www.iccrom.org/projects/net-zero-heritage-climate-action), gathering indigenous knowledge to mitigate the climate crisis in five climate hotspots. The initiative worked on case studies in Brazil, Egypt, India, Sudan, and Uganda.
- The involvement of local communities, particularly school-aged youth, is one of the main activities of the **Stećci project**. Citizen science and storytelling activities with the participation of schools have been carried out in Bosnia and Herzegovina and Montenegro (steccihorizoneu.com).
- Similarly, the **Mountainscape**: Unveiling Cultural Treasures in the High Peaks of Kosovo and Albania project focuses on engagement and collaboration with local communities in its research, documentation, and dissemination activities (chwbkosova.org).
- As regards sustainable tourism and community involvement: **TexTour** project, Rethinking Cultural Tourism in Europe and beyond, https://textour-project.eu/ . The involvement of heritage communities in heritage management is coordinated in Italy by the Faro Italia network (Genovese et al. 2024[14]).

5. Next steps and way forward

This document presents a summary of initial-stage discussions towards developing a consultative roadmap on strategic R&I needs and priorities for the protection of cultural heritage from the impacts of extreme hydroclimatic events. Being a working and living document, it shall be updated over time, following a series of stakeholder consultations and feedback and input gathering events.

When completed, the SD-WISHEES partnership believes that the consultative roadmap will provide a good basis for efforts made towards enhancing and widening collaborative R&I targeting the protection and adaptation of cultural heritage in Europe, Africa, and beyond, threatened by hydrometeorological extremes. Going forward,

- We invite the European Union and the widening countries, specifically including the Balkans and Africa (though the African Union), the international community,

[14] Genovese L., L. Alberti, F. Colosi, M.C. Grano, A. Bellia, S. Greco, C. Sfameni, M. Lazzari (2024), Cooperation Solutions for the Local Sustainable Development of Heritage Communities: Role and Contributions of the Faro Italia Network, in S. Calabrò et al. (eds.), Networks, Markets & People, vol. 2, Springer, pp. 340-353.

national, regional and local governments, civil society, and all stakeholders to mobilize resources to support actions aimed at the protection and adaptation of cultural heritage from the impacts of hydroclimatic extreme events.

- We invite regional and local actors to localize this roadmap to facilitate local and regional actions aimed at enhancing the protection and adaptation of cultural heritage threatened by hydroclimatic extremes in their areas.
- We also intend to proactively engage with some of the people that do not have an international voice - the marginalized communities that are vulnerable to devastating effects on their lives and wellbeing, and at risk of losing their cultural roots. This will help in understanding some of the underlying issues that are being overlooked. For example, in the World Water Forum, we invited leaders of indigenous communities in Nepal and Canada that have personal experience of climate induced effects. The goal was to learn about their adaptation, but it is clear that these communities need a much greater focus on scientific solutions that can save their cultural heritage, without which their way of life will be gradually eroded.

Appendices

SD-WISHEES project. Milestone 10. Literature review on identified/ existing policy, R&I and sustainable practice gaps